measured by Mangal *et al*, to be 2.8% as compared to 356 KeV gamma-ray. Therefore, the relative intensity of 222 KeV gamma-ray relative to 356 gamma-ray comes out to be 0.28 ± 0.03. The error includes the summing effect of the K-x ray which is in coincidence with all the gamma-ray transmitions because of the electron capture decay of Ba^{133}.

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THERMOELECTRIC POWER OF TUNGSTENITE (WS_2) SINGLE CRYSTALS

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Thermoelectric power of naturally occuring single crystals (hexagonal) of tungstenite (WS_2) have been measured against copper along both the crystallographic directions and over the temperature range 300°K to 820°K. The results of preliminary measurements are shown in table 1 and in figures 1 and 2.

It is observed from the table I, that at the vicinity of room temperature the thermoelectric powers of crystals 1 and 3 are positive in both the crystallographic directions while that of crystal 2 is negative in these directions. The magnitude of thermoelectric power at room temperature which varies from sample to sample (evidently due to differences in the impurity contents which however has not been analysed) has been found to be slightly different in different crystallographic direc-

Table I

Thermoelectric power in WS_2 crystals along both the crystallographic directions at an ambient temperature 312°K (temperature gradient within 2°C to 3°C)

Crystal	t.e.p. along the c-axis in μv/°C	Activation energy along the C-axis		t.e.p. $\perp^r$ to c-axis in μv/°C	Activation energy $\perp^r$ to C-axis	
		within the range 300°–400°K.	within the range 400°–820°K.		within the range 300°–400°K.	within the range 400°–820°K
1.	+ 4.0	0.5 ev	0.5 ev	+16.0	0.5 ev	0.47 ev
2.	−35.6	0.19 ev	0.33 ev	−33.5	0.28 ev	0.32 ev
3.	+ 4.7	0.34 ev	0.47 ev	+ 5.0	0.37 ev	0.45 ev
4.	+ 3.4	0.39 ev	0.44 ev	—	—	—

tions. At higher temperatures (fig. 1 and fig. 2) the t.e.p. of crystals having positive sign at room temperature remains always positive throughout the range of temperature studied. But in case of crystals with negative thermoelectric

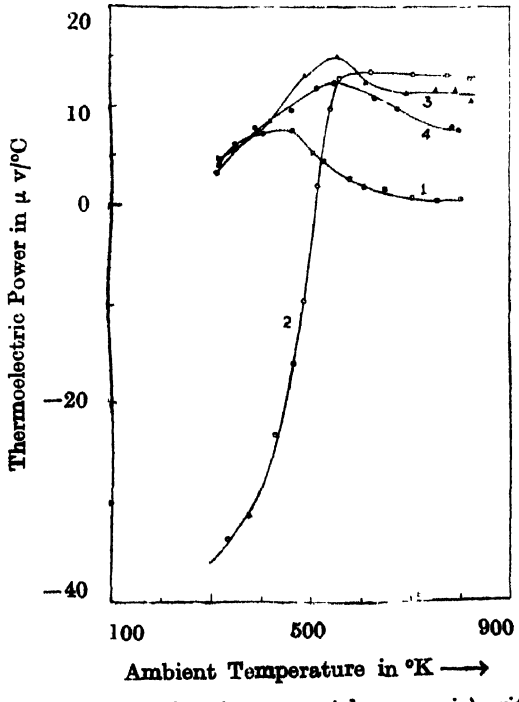

Fig. 1. Variation of thermoelectric power (along c-axis) with temperature. The number on the curve indicates the serial number of the crystal.

power at room temperature, the sign changes from negative to positive with the rise of temperature, and retains this positive sign at higher temperaures. Preliminary measurements of Hall effect with single crystals of WS_2 also appear to corroborate the above findings.

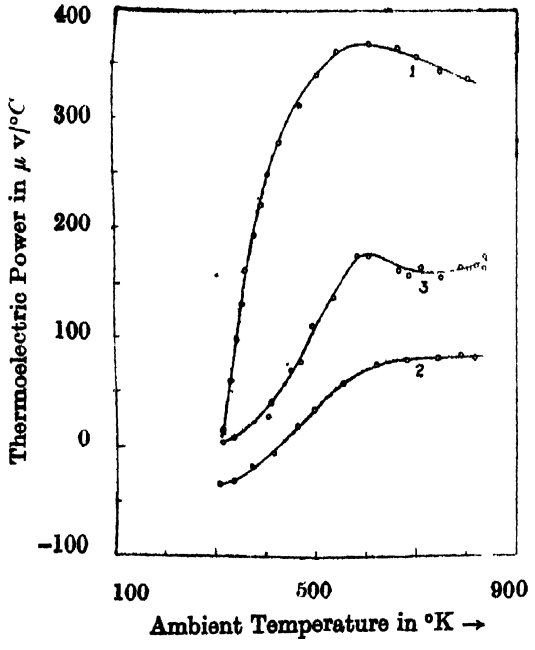

Fig. 2. Variation of thermoelectric power ($\perp r$ to c-axis) with temperature. The number on the curve indicates the serial number of the crystal.

It may be mentioned here that Lagrenaudie (1954) from Hall effect measurements (within the temperature range 77°K—293°K) with powered (artificial) WS_2 (activation energy 0.04 ev, 0.11 ev, 0.18 ev), observed that it was a *p*-type semiconductor, while Jean Decrue (1956) from electrical conductivity measurements in different atomspheres showed that powered (artificial) WS_2 (activitation energy 0.17 ev) was a *n*-type semiconductor, within the temperature range 297°K—373°K.

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